Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(EEE)/SEM-7/EEE-704C/2011-12

2011

UTILIZATION OF ELECTRIC POWER

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) For high frequency Eddy current heating, the depth of penetration is

      a) proportional to frequency

      b) inversely proportional to frequency

      c) proportional to square of frequency

      d) inversely proportional to square root of frequency.

   ii) Dielectric heating uses

      a) high frequency b) low frequency

      c) power frequency d) any of a, b, c.

iii) Some applications of dielectric heating are

a) plywood industry

b) tobacco industry

c) both (a) and (b)

d) none of these.

iv) A direct care type induction motor is suitable for

a) intermittent use

b) continuous use

c) both (a) and (b)

d) none of these.

v) Compared to D.C. are welding on A.C. are welding has

a) lower power consumption but higher efficiency

b) lower power consumption and lower efficiency

c) higher power consumption and lower efficiency

d) higher power consumption and higher efficiency.

vi) Butt welding is a type of

a) resistance welding

b) arc welding

c) atomic hydrogen welding

d) none of these.

vii) A lamp with a reflector is mounted 10 m above the centre of a circular area of 20 m diameter. If the combination of the lamp and the reflector gives a uniform CP of 800 over the circular area, the minimum illumination in the area is

a) 4·0 lux b) 2·8 lux

c) 6·0 lux d) None of these.

viii) Sodium vapour lamps use

a) high leakage reactance transformer

b) a capacitor

c) both (a) and (b)

d) none of these.

ix) Typical efficiency of High Pressure Mecury Vapour lamps lie in the range

a) 80 – 100 lumens/watt

b) 0 – 10 lumens/watt

c) 30 – 40 lumens/watt

d) 100 – 200 lumens/watt.

x) Types of traction sub-stations depend on

a) nature of the primary supply

b) system of electrification

c) both (a) and (b)

d) none of these.

xi) Smoothing chokes are used in

a) an *a.c.* locomotive

b) a *d.c.* locomotive

c) both (a) and (b)

d) none of these.

xii) Electrodiposition typically requires

a) high current and voltage

b) high current and low voltage

c) low current and high voltage

d) low current and low voltages.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. a) Define Luminous Intensity and Luminous Flux. 2

   b) An office 25 m × 12 m is illuminated by 40 w in candescent lamps of 2700 lumens. The average illumination required at work place is 200 lux. Calculate the number of lamps required to be fitted in the office. Assume utilization and depreciation factors are 0·65 and 1·25 respectively. 3

3. Describe the working principle of a mercury vapour lamp. 5

4. Eddy current heating is used for hardening of a steel pulley and the depth of penetration required is 1·4 mm. The relative permeability is unity and $f = 5 \times 10^{-7}$ Ω m for steel. Determine the frequency required. 5

5. Why is a *d.c.* series motor suited for traction ? With the help of speed-torque characteristics explain how speed can *bc* maintained for a *d.c.* series motor used for traction when the load increases. 2 + 3

6. Write short notes on the following :

   a) arc welding

   b) spot welding.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. A piece of an insulating material is heated by di-electric heating. The size of the piece is 12 cm ∞ 12 cm ∞ 3 cm. A frequency of 20 MHz is used and the power obserbed is 450 W. If the material has a relative permitirity of 5 and a power factor of 0·05 calculate the voltage necessary for heating and the current that flows in the material. Deduce any formula used.

8. A low frequency induction furnace operating at 12 V in secondary circuit takes 480 kW at 0·5 pf when the hearth is full. If the secondary voltage be maintained at 12 V, estimate the power absorbed and the power factor when the hearth is half full (Assume that the resistance of the secondary halved and the reactance remains constant).

   What are the disadvantages of vertical care type induction furnace ? 12 + 3

9. a) What are the requirements of an ideal traction system. 4

   b) What are the different systems of railway electrification ? 3

c) What are the disadvantages of 25 kV AC traction system. 3

d) Compare D.C. and A.C. systems of railways electrification from the point of view of main line and suburban railway service. 5

10. With the help of circuit diagram explain the working principle of a fluorescent lamp. What are the normal values of power factor and power consumption for these lamps. Where are they most suited ? 10 + 3 + 2

11. a) State Faraday's Laws of Electrolysis. 4

b) Define equivalent weight and valency. 4

c) A sheet having a surface area of 0·36 m^2 is to be electroplated with copper of thickness 0·0254 mm. Calculate the quantity of electricity required. ECE of copper = 32·95 $\propto 10^{-8}$ kg/c and density of copper is 8900 kg/m^3 . 7